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to follow them satisfactorily. A similar statement might be made regarding the methods of chemical analyses and, in later chapters, on mining methods.

It is unfortunate that with all our classifications of coal none seem to meet with general approval. Probably the best is that adopted by the Twelfth International Congress of Geologists, and which was originally developed by D. B. Dowling of the Canadian Geological Survey. The author favors a classification based upon more than two factors as best meeting the requirements, but admits the inadequacy of those now in use.

The origin of coal, through the transformation of vegetal matter accumulated in swamps, is discussed in considerable detail. The amazing rapidity of the metamorphic processes in any such accumulation is illustrated by the pebbles of coal occurring within the Coal Measures and the alteration of the upper end of a mine prop which had been subjected to high pressure for thirty years, during which time it also felt the effects of the heat from a fire in an adjacent part of the mine. The upper part of the prop and the cap wedge had a jet black color, a bright glossy luster, and conchoidal fracture. Evidently the intensity of the other factors may compensate for the lack of a large portion of the time element usually regarded as essential in the formation of the higher grades of coal.

A chapter is devoted to the vegetation of the coal periods and deals chiefly with the extinct forms. The author then takes up the structural conditions existing in coal seams, the location and determination of thickness of beds, and the value of coal lands. The latest mining methods and the preparation of the coal and coal products for the market are given due consideration. Finally a summary of the geology of the coal fields and the coal resources of the world completes the volume.

The book is adequately illustrated by well-chosen cuts, maps, and photographs. The plan of the text is admirable and the author handles his subject with good clear English, which is free from useless repetition. This has made it possible for him to get a remarkable amount of information into a single volume. Considering its size and scope, it is certainly one of the best texts on coal that has been published.

C. R. S.

Structure in Paleozoic Bituminous Coals. By REINHARDT THIESSEN, United States Bureau of Mines, Bulletin 117, Washington, 1920. Pp. xiii+296. Pls. CLX.

An extensive historical review of previous studies of woody structure in coal is followed by a detailed description of the technique of the

author's investigation. A study of the origin of peat follows, which throws some light on the way in which coal was formed in Paleozoic times. The author's study of the structure of coal embodies the results of his examinations of a number of different Paleozoic coals. Particular attention is given to microscopic studies, many of which were made with a magnification of 1,000 diameters, approaching the limit of visibility.

The text is accompanied by 160 plates, many of which contain several illustrations, and a bibliography of publications on the composition of coal.

An enormous amount of valuable information on the composition of coal has been accumulated in this bulletin. Many side lights on plant life during the Paleozoic are brought out by the study of the spores and other morphological elements of the coal. Biologic factors like the origin of rootlets and the existence of fungi in Paleozoic times, are revealed.

There are a number of theories concerning the origin of coal, but we are yet unable to form a conclusive conception of this interesting geological process. Thiessen's paper supplies a great amount of information which brings us a step nearer to a satisfactory conception.

A. C. N.

Contact-metamorphic Tungsten Deposits in the United States. By FRANK L. HESS and ESPER S. LARSEN. United States Geological Survey, Bulletin 725-D, 1921.

Of the 5,000 tons of tungsten concentrates (reckoned as 60 per cent WO_3) produced in the United States in 1918, about 1,400 tons was in the form of scheelite (CaWO_4) from contact-metamorphic deposits. Most of these deposits are along the western side of the Great Basin in California and Nevada but there are scattered deposits near Great Salt Lake and in Arizona, New Mexico, and Oregon. Their development has been recent, the first of the type being discovered in 1908. During the European war most of them were active producers but by 1920 all had lapsed into idleness because of the severity of competition with imported concentrates and richer American ores, combined with the great depression in the steel industry.

The contact-metamorphic tungsten deposits are nearly all at or near the contact between quartzose igneous rocks, principally granodiorites, and limestones. In a number of districts the deposits are clustered about several small granite outcrops close together, which suggest the presence of a larger granite body beneath.

The silicate minerals are those usual in contact-metamorphic deposits, except that minerals carrying boron appear to be absent and magnetite and hematite are notably rare.